



national accelerator laboratory

EXP-29

January 26, 1973

ACCELERATOR EXPERIMENT--Coherent Extraction

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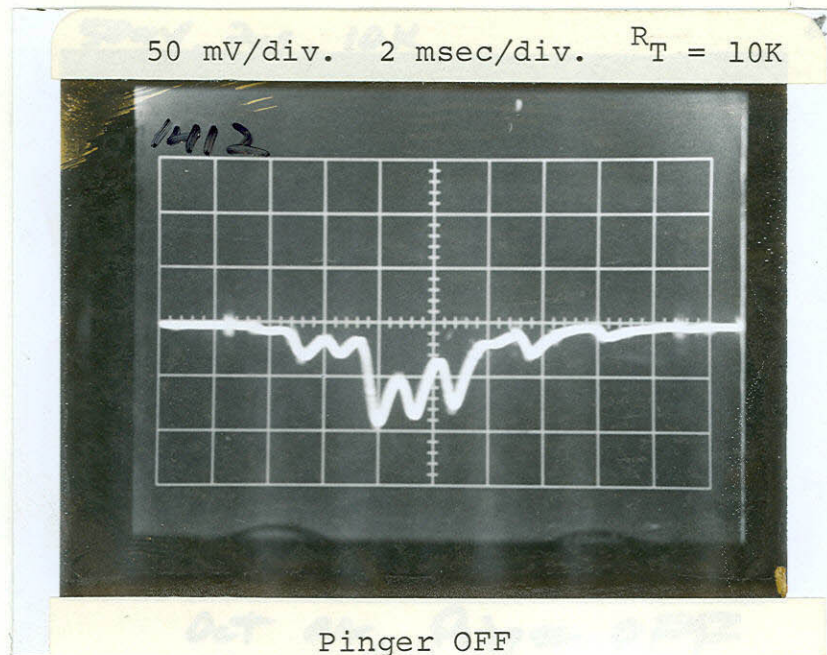
Date Performed: 26 January 1973

An extraction experiment was performed to determine how rapidly and how efficiently multiple bunches could be extracted from the machine. The machine was first adjusted as follows:

- A. Normal resonant extraction was established; i.e.,
 - 1) Main Ring position bump (F46-A17) was set.
 - 2) F-19 quad was set to adjust tune to near resonance.
 - 3) A-2 quad was fed from main ring intensity to move beam into resonance at a rate determined by spill.
 - 4) Above parameters were fine-tuned to optimize extraction efficiency and spill structure. Extraction efficiency was ~85%.
- B. Coherent extraction was then set up as follows:
 - 1) A-2 quad was disconnected from the feedback circuit and pulsed at maximum amplitude directly from the McCarthy pulsing circuit.
 - 2) F-38 air core pinger was turned on to maximum amplitude and timing was adjusted to obtain shortest spill time as indicated by the SEM current signal displayed on an oscilloscope.
 - 3) F-19 quad was adjusted to maximum efficiency to further minimize spill time.

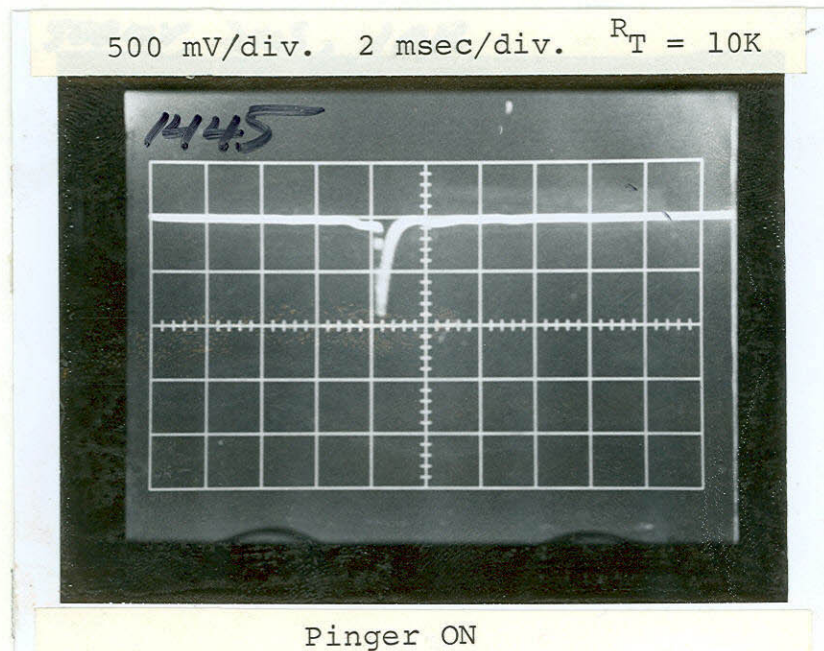
RESULTS

The following photographs illustrate the results (R_T refers to the terminating resistor on the SEM signal):



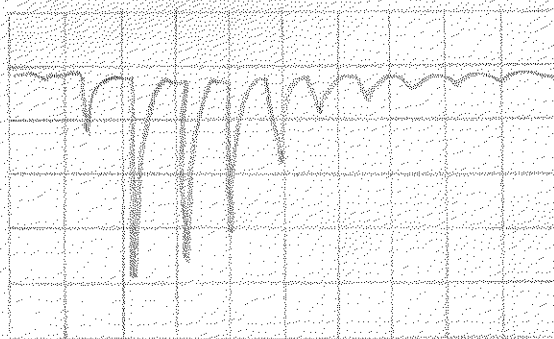
Fast Resonant Extraction (without Pinger)

Note the apparent 720 Hz structure.



Coherent Extraction

(i.e., Fast Resonant Extraction with Pinger)

50 mV/div. 50 μ sec/div. $R_T = 1K$ 

Pinger ON

Coherent Extraction

Same as photo above except with shorter time constant on the electronics.

Note the ~ 25 kHz structure which is indicative of the half integral resonance.

The extraction efficiency was between 95 and 100%. The machine intensity was $\sim 1 \times 10^{12}$ protons/pulse except for the last picture, which was taken when the intensity was $\sim 2.5 \times 10^{11}$ protons/pulse. The experiment was completed in two hours; therefore, a great deal of fine tuning was not attempted.

CONCLUSIONS

1. Without the air core pinger, the most rapidly we can accomplish resonant extraction is approximately 7 msec.
2. With the aid of the air core pinger properly timed (Coherent Extraction), over 70 per cent of the beam can be extracted in less than 300 μ sec and over 95 per cent of the beam extracted in less than 1 msec.

cb

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